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## (54) APERTURE PLUG

(71) We, UNITED-CARR LIMITED, a British company of 27 Regent Street, London, S.W.1, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a plug for closing an aperture in a panel and in particular to a plug for closing and sealing an aperture in a panel.

The subject matter of the present invention is also disclosed in the complete specification of our co-pending Application No. 31937/76 (Serial No. 1,466,564).

It is known to provide a plug for a panel aperture comprising a plate portion and a plurality of resilient legs which depend from the plate portion and which can be snap-engaged through the aperture in the panel so that the plate portion is drawn onto the panel and substantially closes the aperture. Hitherto, the legs have been partially sheared from the plate portion so as to leave gaps in the periphery of the plate portion which reduce the effectiveness of the seal achieved by the plug.

According to the present invention a plug for a panel aperture comprises a plate portion and a plurality of resilient legs which depend from the plate portion and which can be snap-engaged through the aperture in the panel so that the plate portion is drawn onto the panel and substantially closes the aperture, the legs being formed by extensions of the plate portion which have been folded back so as to lie flat against the plate portion and then had their free end portions bent away from the plate portion, so that the legs project from the plate portion from a position radially inwardly of the periphery of the plate portion leaving the periphery of the plate portion unbroken.

Preferably, the part of each leg which is folded back onto the plate portion is sealed in a recess formed in the plate portion so as to lie approximately flush with the surface of the plate portion from which the legs project.

In a further aspect the invention provides a plug for a panel aperture comprising a plate portion and a plurality of resilient legs which depend from the plate portion and which can be snap-engaged through the aperture in the panel so that the plate portion is drawn onto the aperture and substantially closes the aperture, and a sealing member of resilient or deformable material located on the plate portion outside the legs.

The sealing member can comprise a resilient material which is adhered or mechanically attached to the plate portion of the plug. Alternatively, the sealing member can comprise a plastics composition which can be cured and bonded to the plate portion of the plug.

We have also found that it is advantageous to form the sealing member from a plastics material which will flow to a limited extent when subjected to a high temperature. This type of sealing member is particularly useful if the plug is used to seal an aperture in a vehicle body before the vehicle passes through a paint oven. Initially, the plug will make a good seal of the aperture but when the vehicle is subjected to a temperature of 140°—170°C in a paint oven the material of the sealing member will flow to fill any irregularities in the plate portion of the plug or in the part of the vehicle body against which the plug is located and thereby ensure a complete seal. This is particularly useful if the plug is used to seal an aperture in a curved panel.

A preferred form of the invention will now be described with reference to the accompanying drawings, in which:—

Figures 1 and 2 are respectively a plan and elevation of a plug;

Figure 3 is a section taken on the line III—III of Figure 1, showing the plug located in a panel aperture,

Figure 4 is a plan view of the plug of Figure 1 with a sealing ring bonded to it,

Figure 5 is a section on the line V—V of Figure 4,

Figure 6 is an elevation, in section of the plug of Figure 4 attached in and sealing an aperture in a panel and

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Figure 7 is a view similar to Figure 6 showing a modification of the sealing ring of Figures 4 to 6.

In Figures 1 to 3 a metal plug is indicated generally at 10. The plug 10, which is formed from thin sheet steel and rendered resilient during manufacture, comprises a circular plate 11 and three retaining legs 12, 13 and 14. The legs 12, 13 and 14 are equiangularly spaced around the periphery of the plate 11 and each leg includes an outwardly inclined retaining portion 15 and an inwardly inclined lead-in portion 16.

The legs 12, 13 and 14 are similar and each leg is formed from a tongue 17 (shown in broken lines in Figure 1 which is formed integrally with the plate 11 and folded back onto the plate 11 to form a fold 18 from which the respective leg projects at right angles and outwardly from the plate 11. A depression 19 is formed in the plate 11 to receive the fold 18 of each tongue so that the outer surface of the fold is flush with the adjacent surface of the plate. As can be seen from Figure 1 the legs 12, 13 and 14 are spaced inwardly from the periphery of the plate 11 so as to leave a continuous annular surface 20 around the periphery of the plate.

The metal plug 10 can be used, as shown in Figure 3 to close a circular hole 21 in a panel 22. In use, the annular surface 20 is drawn against the outer surface of the panel 22 by the retaining portions 15 of the legs so as to seal the hole adequately for many purposes for instance it can provide an adequate dust seal. The configuration of the legs also enables the plug to withstand considerable pressure.

If, however, a better seal is required then a ring seal of resilient or deformable material can be added to the plug to form a plug 10a as shown in Figures 4 to 6, having a ring seal formed from a polyvinylchloride based compound such as that sold by W. G. Grace & Co. as PLASTICOL Compound No. 1,268.

A layer of the polyvinylchloride based compound is applied to the annular surface 20a of the plug 10a and the compound is cured so as to bond the layer to the plate 11a and form a ring seal 23 outside the legs 12a, 13a and 14a which is bonded to the plate 11a.

The plug 10a is then applied to an aperture 24 in a panel 25, as shown in Figure 6, with the legs 12a, 13a and 14a projecting through the aperture and the rim of the aperture clamped between the inclined retaining portions 15a of the legs and the ring seal 23.

We have found that a suitable polyvinylchloride based compound such as PLASTICOL 1268 can be cured at about 160°C for 1 to 2 minutes so as to bond effectively on

the plate 11a. When cooled it becomes non-tacky and has sufficient resilience to form a good seal against a panel aperture taking up surface irregularities. It will subsequently withstand temperatures of up to 250°C and when re-heated it will soften slightly but will not melt or become tacky.

The plug 10a incorporating the sealing ring 23 has been found satisfactory in most conditions where the surface irregularities in the panel are not too great. If either of these conditions are present then we have found it advantageous to form the sealing ring from a material such as a low density polythene which will flow when heated so as to fill all the surface irregularities of both the panel and the plate portion of the plug.

An example of a plug 10b having a sealing ring 26, which is formed from a low density polythene is shown in Figure 7.

The sealing ring 26 is preferably injection moulded, although it can be blanked from sheet material, and comprises an annular sealing portion 27, a web 28 which is of slightly smaller internal diameter than the diameter of the plate 11b, and a retaining rib 29. The ring 26 is stretched and fitted on the plate 11b where it is retained by the rib 29 with the sealing portion 27 located on the annular surface 20b of the plug.

The plug 10b can be transported and handled with the ring 26 located in position by the resilience of the material and by the retaining rib 29. In use, the plug 10b is applied to an aperture 30 in a panel 31, in the same way as the plug 10 or the plug 10a so that the sealing portion 27 surrounds the panel aperture 30 and is trapped between the panel 31 and the plate 11b. The panel and the plug 10b are then subjected to a temperature sufficient to soften the polythene causing it to flow. As the polythene material softens and flows it fills all of the surface irregularities of the panel 31 and of the plate 11b and also bonds to both the panel and the plate as shown in broken lines in Figure 7 so as to form a water-tight seal.

The plug 10b is particularly useful for sealing apertures in vehicle body panels. In this application, the plug is located in the body panel with the ring 26 loosely fitted on the plate 11b and the body panel and plug are then subjected to the temperatures of 140°C—170°C or more of a vehicle paint oven. The temperature of the paint oven causes the polythene material of the ring 26 to flow filling irregularities in the panel surface and then bond to the panel and plate as it cools.

It will be appreciated that the sealing ring 26 can be attached to the plate portion of the plug in any convenient manner prior to heating and the shape of the sealing ring can also be modified. For instance, the rib 29 could be eliminated and the resulting seal-



ing ring temporarily adhered to the plate portion prior to heating. Alternatively, the sealing ring can be attached to the plate portion of the plug with the aid of prongs, sheared from the plate portion.

5 It will also be appreciated that the material from which the sealing ring is formed can be varied and will be suited to the particular conditions under which the plug is used.

10 The number of legs provided on any of the plugs of the present invention can be varied, for instance, two or more legs can be provided to suit the particular application in which the plug is to be used. In addition, the shape of the plate portion of the plug can be varied, for instance, it can be externally oval, square or elongate and can also be curved to fit a curved surface.

#### 20 WHAT WE CLAIM IS:—

1. A plug for a panel aperture comprising a plate portion and a plurality of resilient legs which depend from the plate portion and which can be snap-engaged through the aperture in the panel so that the plate portion is drawn onto the panel and substantially closes the aperture, the legs being formed by extensions of the plate portion which have been folded back so as to lie flat against the plate portion and then had their free end portions bent away from the plate portion so that the legs project from the plate portion from a position radially inwardly of the periphery of the plate portion leaving the periphery of the plate portion unbroken.

2. A plug as claimed in claim 1 in which each leg is bent to form a snap-engaging knee.

3. A plug as claimed in claim 2 in which each leg has a portion extending substantially at right angles to the plane of the plate portion, followed by the snap-engaging knee comprising an outwardly inclined retaining portion and an inwardly inclined lead-in portion.

4. A plug as claimed in any of the preceding claims in which the part of each leg

50 which is folded back onto the plate portion is situated within a recess formed in the plate portion so as to lie substantially flush with the surface of the plate portion from which the legs project.

5. A plug as claimed in any of the preceding claims including a sealing member of resilient or deformable material located on the plate portion outside the legs so as to overlie at least a part of the folded back portions of the legs.

6. A plug as claimed in claim 5 in which the sealing member is adhered to the plate portion.

7. A plug as claimed in claim 5 in which the sealing member has a groove arranged to contain the periphery of the plate portion.

8. A plug as claimed in claim 5 in which the sealing member is cured and bonded to the plate portion.

9. A plug as claimed in claim 5 in which the sealing member is of a flowable plastics material.

10. A plug for a panel aperture substantially as described herein with reference to Figures 1 to 3 or Figures 4 to 6 or Figure 7 of the accompanying drawings.

11. An assembly of a plug as claimed in any of claims 1 to 4 and a panel having an aperture, the legs of the plug being snap-engaged through the aperture so that the plate portion overlies and substantially closes the aperture.

12. An assembly as claimed in claim 11 including a sealing member situated between the plate portion and the adjacent surface of the panel at a position outside the legs.

13. An assembly of a plug and an apertured panel substantially as described herein with reference to Figure 3 or Figure 6 or Figure 7 of the accompanying drawings.

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COMPLETE SPECIFICATION

1 SHEET

This drawing is a reproduction of the Original on a reduced scale

FIG.1

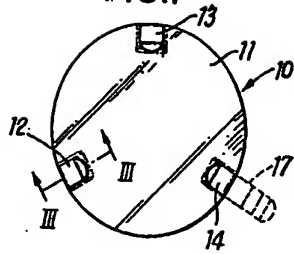


FIG.2

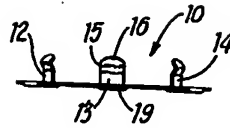


FIG.3

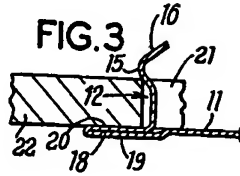


FIG.4

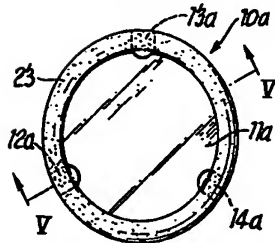


FIG.5

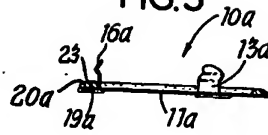


FIG.6

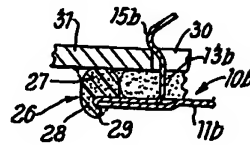
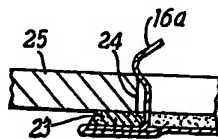


FIG.7